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The Mining of the North: A Review of Andrew Nikiforuk's Tar Sands: Dirty Oil and the Future of a Continent

Andrew C. Mergen

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THE MINING OF THE NORTH: A REVIEW OF ANDREW NIKIFORUK'S TAR SANDS: DIRTY OIL AND THE FUTURE OF A CONTINENT

ANDREW C. MERGEN[1]

In 1956, a petroleum geologist named M. King Hubbert made a controversial prediction: U.S. oil production would peak in the early 1970s. At the time, Hubbert's prediction was widely disputed; in 1970, however, the U.S. production of crude oil started to fall, proving that Hubbert was correct.[2] The concepts that underlie what has become known as "Hubbert's Peak" are relatively straightforward: (1) oil is a finite resource; (2) production starts at zero; (3) production rises to a peak that can never be surpassed; and (4) production declines until the resource is depleted.[3] Put more colorfully by Canadian journalist Andrew Nikiforuk, "[A]s every beer drinker knows, the glass that starts full ends empty."[4] To most credible observers, we now live in a peak oil world.[5] We are well on the way to depleting the world's oil reserves.[6] The glass is headed towards empty.

Professor Hannah Wiseman of the University of Texas Law School notes that "[a]s conventional sources of oil and gas become less productive and energy prices rise, production companies are developing creative extractive methods to tap resources like oil shales and tar sands that were previously not worth drilling."[7] These new methods of energy production, like their predecessors,

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1. Assistant Section Chief, Appellate Section, Environment & Natural Resources Division, U.S. Dep't of Justice. The views expressed herein are the author's and do not necessarily reflect the view of the U.S. Department of Justice or any other federal agency.

2. *See* KENNETH S. DEFFEYES, HUBBERT'S PEAK: THE IMPENDING WORLD OIL SHORTAGE 1-2 (2001) (stating U.S. oil production will peak this decade).

3. *See* Deffeyes, *supra* note 2, at 133-99.

4. *See* ANDREW NIKIFORUK, TAR SANDS: DIRTY OIL AND THE FUTURE OF A CONTINENT 3 (2009) (noting half of world's cheapest, cleanest oil has been consumed).

5. For a particularly thorough and sober discussion of peak oil estimates, see PAUL ROBERTS, THE END OF OIL: ON THE EDGE OF A PERILOUS NEW WORLD 44-65 (2005) (stating easy access to oil reserves has ended).

6. *See* Deffeyes, *supra* note 1, at 133-99.

7. *See* Hannah Wiseman, *Untested Waters: The Rise of Hydraulic Fracturing in Oil and Gas Production and the Need to Revisit Regulation*, 20 FORDHAM ENVTL. L. REV. 115 (2009) (noting that most new extraction techniques are causing disputes as they are occurring close to human populations).

come at some environmental cost.[8] Some of these energy sources, such as coal fired electric plants, are widely criticized for the environmental degradation they cause.[9] For others, like the Marcellus shale development for natural gas, it is unclear whether the most alarming environmental harm is simply a result of sloppy practices that might be controlled through regulation and safeguards, or if the danger is inherent in the extraction of the resource.[10]

It should be apparent, however, that some energy development is likely not worth the long-term harms caused to the environment. For many, foremost among these development methodologies is the exploitation of Canada's so-called tar or oil sands.[11] Although this practice is highly controversial in Canada, many Americans remain ignorant of tar sand mining and the extent to which this mining meets energy needs in the United States. Fortunately, Andrew Nikiforuk's TAR SANDS: DIRTY OIL AND THE FUTURE OF THE CONTINENT is an excellent primer on this controversial practice.[12]

Although most Americans understand that the bulk of the oil we use is imported, many would be surprised to learn that the United States imports more oil from Canada (approximately nineteen percent of its total foreign supply) than from any other nation—including Saudi Arabia—and roughly half of that oil now comes from oil sands.[13] Some estimates project that by 2035, thirty-seven percent of our foreign oil needs could be provided by Canadian oil sands.[14]

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8. *See* Stevan R. Baxter, *Tar Sands: Worth the Energy? An Analysis of the Future of Utah's Tar Sands*, 27 J. LAND RESOURCES & ENVTL. L. 323 (2007) (discussing environmental cost of Utah tar sands development).

9. *See generally* JEFF GOODELL, BIG COAL: THE DIRTY SECRET BEHIND AMERICA'S ENERGY FUTURE (2007) (presenting extreme harms caused to environment by reliance on coal-fired electricity).

10. The use of certain substances, such as diesel fuel, in the hydraulic fracturing of shales for gas can result is contamination. *See* Mike Soraghan, *Two Oil-Field Companies Acknowledge Fracking with Diesel*, www.eenews.net/Greenwire/print/2010/02/19/1 (on file with author). Diesel fuel is not necessary to the process but some companies have none the less acknowledged its continued use despite industry-wide commitments to move to more environmentally benign fracking fluids. *Id.*

11. *See* Barry Yeoman, *Crude Awakening*, AUDUBON MAGAZINE, Mar.-Apr. 2010, *available at* http://www.audubonmagazine.org/features1003/energy.html (describing opposition to tar sands development).

12. *See generally* NIKIFORUK, *supra* note 4 (discussing environmental, social, and political costs of tar sand mining).

13. *See* Yeoman, *supra* note 11 (describing country origins of oil imported into the United States).

14. *See id.* (noting some estimates project oil from Canada's tar sands will supply United States thirty-seven percent of its oil needs by 2035).

This resource is strikingly different from conventional sources of oil. The substance mined from the tar sands—and mined is the right word since development of the tar sands requires massive amounts of earth moving equipment—is "bitumen," a thick gooey substance that looks and smells like tar.[15] In order to convert it into oil, the hydrocarbons that constitute bitumen are upgraded into a synthetic crude oil.[16] Unlike oil, bitumen cannot be sucked or pumped out of the ground.[17] About twenty percent of the Canadian tar sand deposits are shallow enough to be mined by four hundred ton Caterpillar trucks and electric shovels.[18] The trucks burn fifty gallons of diesel fuel an hour.[19] The mining of bitumen also requires the removal of the surrounding forest and the draining of surrounding wetlands. About four tons of earth needs to be moved to obtain two tons of bituminous sand.[20] Since 1967, one company has moved and extracted the equivalent of two billion tons of earth.[21]

Most of the tar sands, however, lie in deep formations that cannot be mined in open pits.[22] Instead, the deposits are developed in situ by injecting steam underground and pumping up the softened product.[23] This methodology, known as steam-assisted gravity drainage (SAGD), degrades the surrounding forest.[24] Nikiforuk explains that the typical project occupies a three-mile by three-mile area and destroys seven percent of the land.[25] The technique requires a substantial infrastructure of supporting roads, pipelines and seismic lines.[26] SAGD also requires natural gas to obtain the steam that ultimately frees the bitumen.[27]

15. *See* Robert Kunzig, *The Canadian Oil Boom*, NAT'L GEOGRAPHIC, Mar. 2009, at 46-48 (describing bitumen mined from tar sands).

16. *See* NIKIFORUK, *supra* note 4, at 13 (describing bitumen conversion process).

17. *See id.* at 13.

18. *See id.* at 13-14 (noting percentage of Canadian tar sands shallow enough to mine).

19. *See* Kunzig, *supra* note 15, at 48 (noting large amount of fossil fuels expended by large trucks in tar sand mining operations).

20. *See* NIKIFORUK, *supra* note 4, at 14 (noting four tons of earth must be moved to obtain every two tons of bituminous sand).

21. *See id.* (providing specific examples of amount of earth moved in mining process).

22. *See id.* (describing formation locations).

23. *See id.* (describing steam process).

24. *See id.* (describing environmental impact of SAGD on surrounding forests).

25. *See* NIKIFORUK, *supra* note 4, at 14 (noting impact on surrounding land).

26. *See id.* (describing infrastructure of SAGD).

27. *See id.* (explaining use of steam).

Nikiforuk refers to the resource as "Tar Sands" and deliberately titles his book with this term to emphasize the point that the substance mined does not start as oil.[28] Oil is something that is produced well after the bitumen has been extracted, and referring to this resource as "oil sands" creates the misimpression of a ready energy seeping from the sands and soil when the truth is that extracting this resource is extremely difficult.[29] Indeed, Nikiforuk quotes (anonymously) one industry executive as describing the bitumen mining process as an "environmental freakshow."[30]

The American motorists whose cars may be fueled by gas derived from the tar sands are far removed from the freakshow. Alberta's bitumen sands development is centered in the Athabasca river valley, north of Edmonton, Alberta, and some 800 miles from Alberta's border with the United States.[31] The country is a wet and rolling fen, with many lakes and smaller trees.[32] This terrain is part of Canada's boreal forest that, like the tropical rainforests, serves as an important carbon sink in a warming world.[33] This area also provides habitat to many mammals, fish and bird species.[34] The boreal forest ecosystem is especially known for its importance to songbirds and neotropical migrants.[35] The loss of forest habitat has devastated avian species.[36] The short-billed dowitcher's breeding grounds, for example, have been severely impacted by tar sands development.[37] Its numbers are down at least half from historical records.[38] In 2008, for example, more than 1,600 waterfowl died on a tar sands mine tailings pond.[39]

Mammals are also at risk. The region is home to woodland caribou but the fragmentation of habitat and the loss of wildlife

28. *See id.* at 12 (illustrating origin of oil).

29. *See id.* at 14 (illustrating origin of oil).

30. *See* NIKIFORUK, *supra* note 4, at 14 (noting sentiment from oil sands industry).

31. *See* Yeoman, *supra* note 11, at 78(describing location of tar sands).

32. *See* Kunzig, *supra* note 15, at 38 (describing the landscape).

33. *See* NIKIFORUK, *supra* note 4, at 119 (noting that the region's forests and peat bogs bank twice as much carbon as a tropical forest).

34. *See* Yeoman, *supra* note 11, at 78 (describing inhabitants of boreal forest).

35. *See id.* (describing inhabitants of boreal forest).

36. *See State of the Birds 2009* at 12, *available at* www.stateofthebirds.org.

37. *See* Yeoman, *supra* note 11, at 78 (noting tar sands impact on short-billed dowitcher).

38. *See id.* (noting tar sands impact on short-billed dowitcher).

39. *See* Alexandra Zabjek, *Snowfall Stalled Efforts to Scare Off Birds, Trial Told,* EDMONTON J. (Mar. 5, 2010), *available at* http://www.vancouversun.com/story_print.html?id=2641778&sponsor (noting tar sands impact on waterfowl population).

travel corridors adversely affect these animals.[40] A 2001 study showed that the animals refused to pass within 3,300 feet of oil and gas wells or 800 feet of roads and seismic lines cut for geophysical exploration.[41] Among other things, this fragmentation of the habitat makes the animals much more vulnerable to predation.[42] Nikiforuk describes a 2008 study that disclosed that SAGD, as currently designed, would extirpate caribou, fish, bear and moose over a region ranging from one to three million acres in size.[43]

While tar sands mining undoubtedly harms the wildlife of the region, it also puts human communities at risk.[44] The Alberta tar sands are home to the indigenous people of Canada, or "First Nations," including Cree and Chipewyan Indians.[45] Recent studies show these First Nation populations, who are much more likely to engage in subsistence hunting and fishing than other communities, have suffered outsized cancer levels.[46]

Nikiforuk does not focus solely on the harm that tar sand mining has brought to Alberta's First Nations. Rather, he examines the damage done to everyone in the vicinity of the tar sands boom. In a particularly strong chapter on living and dying in the vicinity of the tar sands boom, Nikiforuk describes the mayhem that unfolds on Highway 63, a heavily trafficked, 150-mile long, all weather road that closes the gap between Edmonton and Fort McMurray in the heart of the tar sands country.[47] The road ferries the highest tonnage of any road in Canada, including heavy machinery and wide loads, and is notorious for its motor vehicle fatalities.[48] Nikiforuk informs us that, in recent years, the International Brotherhood of Electrical Workers alone has lost thirteen members on the highway.[49]

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40. *See* NIKIFORUK, *supra* note 4, at 14, 95.

41. *See* Yeoman, *supra* note 11, at 82 (discussing several studies of woodland caribou).

42. *See* Zabjek, *supra* note 39 (describing wildlife susceptibility to predation).

43. *See* NIKIFORUK, *supra* note 4, at 14 (describing report by industry-funded Cumulative Environmental Management Association (CEMA)). Several such CEMA studies are available online at www.cemaonline.ca.

44. *See* Yeoman, *supra* note 11, at 82 (describing health risks posed by tar sands mining).

45. *See* Kunzig, *supra* note 15, at 42-43 (explaining that First Nations of Northern Alberta were cut off from outside world until tar sands industry transformed area).

46. *See* Yeoman, *supra* note 11, at 82 (discussing 2006 study by physician Jim O'Connor).

47. *See* NIKIFORUK, *supra* note 4, at 14.

48. *See id.* at 37.

49. *See id.* at 37-38.

Nikiforuk also touches on other elements of energy boom living. In many ways, little has changed since the California or Klondike gold rushes, but now social scientists are better able to describe how such booms affect human communities just as ecologists are able to describe how energy development affects animal communities. Nikiforuk discusses the so-called Gillette syndrome, named for a Wyoming ranching community transformed by a coal mining boom.[50] It consists of "human ecosystem wastage" in the form of divorce, drunkenness, depression and death.[51] Fort McMurray, in the heart of the tar sands, reports five times more drug offenses than the rest of Alberta, and has an eighty-nine percent higher rate of assault and 117 percent higher rate of impaired driving.[52]

At this juncture, a skeptical reader might ask, "So what?" After all, many forms of energy development threaten wildlife, and economic booms of all sorts, if not carefully managed, can disintegrate communities in a wash of easy money. These sorts of harms can arguably be mitigated with careful planning and vigilance. Even the downstream health risks might be eliminated with proper controls. Moreover, the tar sands represent a considerable resource in a world desperate for new sources of oil and energy. The proven reserves in the oil sands are eight times those of the entire United States and immediately propel Canada to second place, behind Saudi Arabia, among oil-producing nations.[53] Three additional issues explored in Nikiforuk's book, however, convincingly argue that the tar sands are a poor way for North America to meet its energy needs and that future development of the Canadian tar sands and similar resources in the United States should be resisted. These issues are as follows: (1) the impacts and demands that the development places on water resources[54]; (2) the energy required to convert the tar sands to usable oil[55]; and (3) the climate change implications of tar sands development.[56]

Nikiforuk explains that tar sands development places massive demands on water resources. On average, the open-pit mines re-

50. *See id.* at 37-38.

51. *See id.* at 42-43 (discussing U.S. psychologist ElDean V. Kohrs' identification of social costs of boom development).

52. *See* NIKIFORUK, *supra* note 4, at 44 (explaining that combination of young workers and economic boom has created thriving market for illegal substances).

53. *See* Kunzig, *supra* note 11, at 48 (citing 2003 Oil & Gas Journal's list of proven reserves).

54. *See* NIKIFORUK, *supra* note 4, at 57-77 (describing water issues).

55. *See id.* at 129-39 (describing energy demands of the process).

56. *See id.* at 117-29 (describing climate implications of tar sands mining).

quire twelve barrels of water to make one barrel of bitumen.[57] The water is needed for a hot water process used to separate the hydrocarbons that make up the bitumen from the sand and clay.[58] Although the water used in the open pit mining can be (and is) recycled, every barrel of bitumen consumes a net average of three barrels of water.[59] Nikiforuk places bitumen production at one million barrels a day and accordingly concludes that the industry virtually exports three million barrels of water a day from the Athabasca River.[60] It remains an open question, currently under review in Canada, whether there will be sufficient flows to support fish and aquatic life after all the water withdrawal permits for tar sands production issued by the Alberta government are developed.[61]

The SAGD method of development also places considerable demands on water resources, but unlike open pit bitumen mining methods, the water used to generate the steam used to melt bitumen in deep formations tends to come from underwater aquifers.[62] Given the expansion of SAGD, Nikiforuk predicts that the amount of water necessary to develop these resources will rival open pit mine water use within the decade.[63] The problem with the depletion of groundwater is that it changes the water table over time. Eventually, depleted aquifers are filled again with surface water, which further depletes the surface flows necessary to maintain fish and wildlife.[64]

The water issues related to tar sands development do not relate solely to water quantity issues—water quality and water pollution issues also abound. Tar sands development produces enormous tailings or sludge ponds consisting of the liquid waste by-products of the mining process. Nikiforuk informs us that there are currently twenty-three square miles of tailings ponds along the Athabasca River.[65] An average of 400 million gallons of sludge waste is produced each day,[66] and the ponds contain heavy metals

57. *See id.* at 61-62 (describing water used in process).

58. *See id.* (describing water used in process).

59. *See* NIKIFORUK, *supra* note 4, at 61-62 (describing water used in process).

60. *See id.* at 62 (estimating daily exports from the Athabasca River).

61. *See id.* at 61-62 (questioning whether there remains sufficient water in the Athabasca River for fish).

62. *See id.* at 66-67 (describing water demands of SAGD).

63. *See id.* at 67 (describing water demands of SAGD).

64. *See* NIKIFORUK, *supra* note 4, at 69 (describing depleted aquifers and corresponding environmental concerns).

65. *See id.* at 78 (providing statistics on trailing ponds).

66. *See id.* at 78 (giving statistics on sludge waste).

as well as known carcinogens.[67] The ponds pose a threat to water quality and to the health of people living downstream; as noted above, this results in the death of thousands of birds, as well as moose, deer and beaver.[68] SAGD more frequently utilizes salt-laden groundwater to produce steam, but tar sand operations cannot use these brackish waters for steam without creating salt and minerals out of the water.[69] The improper disposal of the resulting waste material risks further contamination of both surface and groundwater.[70]

The expansion of SAGD in the tar sands highlights another significant problem with this energy resource, namely its dependence on natural gas to generate the steam necessary to obtain the bitumen.[71] According to Nikiforuk, SAGD technology burns enough natural gas to heat four million North American homes every day.[72] Natural gas accounts for more than sixty percent of the operating costs for a SAGD project.[73] By some estimates, SAGD development could consume the entire natural gas supply of Western Canada by 2025.[74] The prodigious use of natural gas in the SAGD process means that, in the long run, the bitumen of the Athabasca sands is marked by a much lower energy return than conventional oil development.[75]

The use of natural gas also means that SAGD activities leave a profoundly large carbon footprint. In the open pit bitumen mines, two tons of dirt must be moved by monster trucks and then upgraded at facilities using natural gas in order to produce one barrel of oil.[76] The SAGD process creates nearly twice as much carbon dioxide as the open pit mines.[77] As a result, every barrel of bitumen produced from SAGD creates, on average, three times more carbon dioxide emissions (187 pounds) than a barrel of normal crude (sixty-three pounds).[78] Futher, as Nikiforuk observes, most

67. *See id.* at 79 (noting contents of ponds).

68. *See id.* at 81 (describing dangers of polluted ponds).

69. *See* NIKIFORUK, *supra* note 4, at 69 (describing how steam process results in salt waste).

70. *See id.* at 69 (noting hazards of improper disposal).

71. *See id.* at 119 (describing natural gas use).

72. *See id.* at 14.

73. *See id.* at 15.

74. *See* NIKIFORUK, *supra* note 4, at 68.

75. *See* Kunzig, *supra* note 15, at 48 (comparing use of natural gas to produce bitumen as like using gold to produce lead).

76. *See* NIKIFORUK, *supra* note 4, at 119.

77. *See id.*

78. *See id.*

statistics on the carbon intensity of bitumen mining fail to take into account the destruction of the boreal forest. This forest banks atmospheric carbon and bitumen mining subverts that function by cutting down trees and draining peat bogs.[79]

In the end, Nikiforuk makes a compelling case that Canada's tar sands development rivals the environmental degradation caused by coal mining in the Appalachian Mountains.[80] To be sure, many of the problems described by Nikiforuk may be mitigated in the future by emerging technologies. Mechanisms are currently under consideration that could reduce natural gas use and pump excess carbon dioxide into coal beds deep within the earth (so-called carbon sequestration) and increase water use efficiency.[81] Nevertheless, recent polling in Canada found that seventy-one percent of Albertans favored a moratorium on new tar sands projects until environmental concerns can be better addressed.[82] Nikiforuk's book convinces me that the government of Alberta would be wise to honor this poll result.

Reporting, like that done by Nikiforuk, will be crucial to making wise choices about energy development in the future. The energy economy is global and we must agitate, as global citizens, for wise development decisions. Other emerging fossil fuel sources, perhaps the natural gas now being recovered in Pennsylvania's Marcellus shale, can be developed more benignly than some other sources of energy. Smart energy decisions in the future will depend on hard hitting reporting like Nikiforuk's.

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79. *See id.*
80. *See id.* at 57.
81. *See* Baxter, *supra* note 8, at 340.
82. *See* Kunzig, *supra* note 15, at 58.